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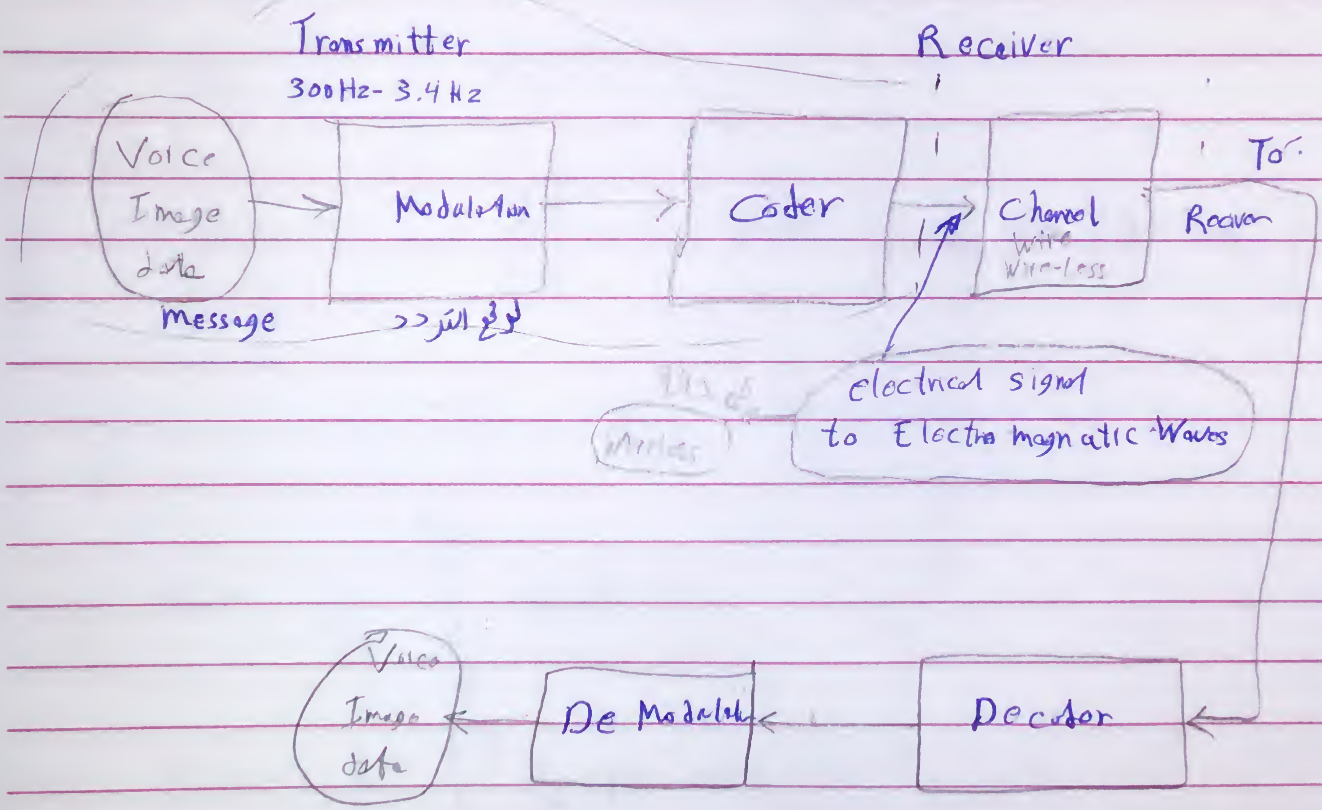
Communication systems

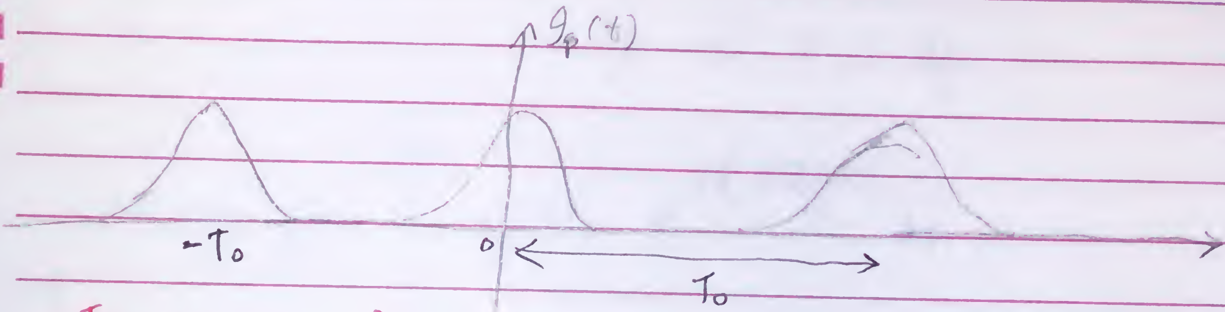
① Signal and systems
② Amplitude Modulation (AM)
③ Angle Modulation (PM, FM)
④ Transmission Media



Chapter 1 : Signals and systems

[1] Fourier series:

- يمكن من خلالها التعبير عن أي Periodic signal من خلال Sine, Cosine



Trig geometric fourier series

$$g_p(t) = a_0 + 2\sum_{n=1}^{\infty}\left[a_n \cos\left(\frac{2\pi n}{T_0}t\right) + b_n \sin\left(\frac{2\pi n}{T_0}t\right)\right]$$

$$\frac{-T_0}{2} \le t \le \frac{T_0}{2}$$

$$a_0 = \frac{1}{T_0}\int_{-T_0/2}^{T_0/2} g_p(t)\,dt$$

$$a_n = \frac{1}{T_0}\int_{-T_0/2}^{T_0/2} g_p(t)\cdot\cos\left(\frac{2\pi n t}{T_0}\right)dt$$

$$b_n = \frac{1}{T_0}\int_{-T_0/2}^{T_0/2} g_p(t)\cdot\sin\left(\frac{2\pi n t}{T_0}\right)dt$$

even → $a_n = \checkmark$ $\quad b_n = 0$

odd → $a_n = 0$ $\quad b_n = \checkmark$

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Expenintiol Fourier Series :

$$g_p(t) = \sum_{n=-\infty}^{\infty} C_n \, e^{j\frac{2\pi n t}{T_0}}$$

$$-\frac{T_0}{2} \leq t \leq \frac{T_0}{2}$$

$$C_n = \frac{1}{T_0} \int_{-T_0/2}^{T_0/2} g_p(t) \cdot e^{-j\left(\frac{2\pi n t}{T_0}\right)} \, dt$$

Dirichlets Condition:

شرط لابد من تحققها حتى يمكن إستخدام Fourier

① The function $g_p(t)$ has single valued within T_0

② Integrable absoulutely $\int_{-T_0/2}^{T_0/2} |g_p(t)| \, dt < \infty$

③ $g_p(t)$ has a finite number of maximum and minimum

حساب القدرة بإستخدام Fourier series

$\boxed{R = 1\,\Omega}$ القدرة محسوبة بفرض أن

$g_p(t)$ لا تعبير عن تيار وجهد

$$P_{avg.} = \sum_{n=-\infty}^{\infty} |C_n|^2$$

Parseval's ~~Parseval's~~ theorem

الإثبات

$$P = \frac{1}{T_0} \int_{-T_0/2}^{T_0/2} |g_p(t)|^2 \, dt$$

$$g_p(t) = \sum_{-\infty}^{\infty} C_n \, e^{j\frac{2\pi n t}{T_0}}$$

$$|g_p(t)|^2 = g_p(t) \cdot g_p^*(t)$$

$$P = \frac{1}{T_0} \int_{-T_0/2}^{T_0/2} g_p^*(t) \cdot \sum_{n=-\infty}^{\infty} C_n \, e^{j\frac{2\pi n t}{T_0}} \, dt$$

$$P = \frac{1}{T_0} \sum_{-\infty}^{\infty} C_n \int_{-T_0/2}^{T_0/2} g_p^*(t) \cdot e^{j\frac{2\pi n t}{T_0}} \, dt$$

$$C_n = \frac{1}{T_0} \int_{-T_0/2}^{T_0/2} g_p(t) \, e^{-j\frac{2\pi n t}{T_0}} \, dt$$

$$C_n^* = \frac{1}{T_0} \int_{-T_0/2}^{T_0/2} g_p^*(t) \, e^{j\frac{2\pi n t}{T_0}} \, dt$$

$$\boxed{P = \sum_{-\infty}^{\infty} C_n \cdot C_n^*}$$

$$\boxed{P = \sum_{-\infty}^{\infty} |C_n|^2}$$

في حالة وجود مقاومة

لو $g_p(t) \rightarrow$ جهد

$$P = \frac{P}{R}$$

$g_p(t) \rightarrow$ تيار

$$\boxed{P = P \cdot R}$$